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Chicken Feet Luncheon Meat

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ABSTRACT

This study developed chicken feet luncheon meat as an alternative processed meat product and assessed its production process, physicochemical properties, microbiological quality, consumer acceptability, nutritional composition, and cost. Research and development, experimental, and descriptive methods were employed. Three formulations were prepared through kitchen trials involving cleaning, deboning, grinding, blending, molding, curing, canning, cooling, and labeling. The third trial was selected for laboratory analysis and sensory evaluation. The reported final recipe combined 300 g of ground chicken feet, 100 g of chicken meat, 100 g of arrowroot flour, and seasonings. Thirty evaluators comprising cookery students, teachers, and potential consumers assessed appearance, aroma, taste, and texture using a five-point scale. Weighted means indicated highly acceptable ratings for appearance (4.83), aroma (4.90), taste (5.00), and texture (4.90), with an overall mean of 4.91. Laboratory results showed moisture content of 58.93%, water activity of 0.98, and yeast and mold counts of 100 CFU/g, below the reference limit reported in the study. Nutritional analysis indicated 89 kcal, 0 g reported fat, 16 g carbohydrates, and 6 g protein per 55 g serving. The reported production cost was ₱86.09, with a proposed selling price of ₱137.74. Findings demonstrate sensory acceptance and potential for adding value to poultry by-products. However, elevated water activity warrants careful preservation and storage management. Further research should validate the formulation, nutrient labeling, microbial safety, thermal processing, shelf life, and production economics before commercialization. The study contributes preliminary evidence for sustainable product development and alternative protein utilization within the Philippine food processing sector.

Keywords: *chicken feet, luncheon meat, poultry by-products valorization, collagen, sustainable meat processing, food product development, consumer acceptability, nutritional composition*

INTRODUCTION

With the recent demands of a fast-changing world, meal preparation has also adapted to people's lifestyles. Healthy meals from canned products have significantly invaded the market and gained popularity. One of these products is the all-time favorite breakfast—the luncheon meat. Luncheon meat is a meat product that Filipino consumers have long enjoyed due to its convenience, long shelf life, and versatility in Filipino households. It makes up a significant part of the country's processed meat sector (Agriculture and Agri-Food Canada, 2023; Golloso-Gubat, 2024). The Philippine processed meat industry generates about PHP 45 billion annually and continues to grow, with luncheon meat being one of the most consumed and exported products (Department of Trade and Industry - Board of Investments, n.d.). However, increasing consumer health awareness and the global demand for sustainable food systems have created a need for

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healthier, more affordable, and resource-efficient meat products (Shakil et al., 2022; Gupta, 2025). The current formulations of traditional luncheon meat, which contain fat levels between 15–25% and include high sodium content, do not meet modern nutritional standards, highlighting the need for innovative product development.

Meanwhile, the organic waste generated in the Philippine poultry industry is significant, with chicken feet comprising about 2–3 percent of the live bird weight, and they have long been undervalued at 20–30 percent of the price of breast meat, despite their potential nutritional value (Woo et al., 2023). This economic imbalance and limited value-added applications result in resource inefficiency in the poultry supply chain. Currently, chicken feet are mainly used to prepare traditional dishes or are exported to overseas markets where they fetch higher prices, indicating that local value addition for chicken feet is underutilized.

This research directly supports several United Nations Sustainable Development Goals (SDGs): SDG 2 (Zero Hunger), SDG 12 (Responsible Consumption and Production), and SDG 8 (Decent Work and Economic Growth). The valorization of agricultural by-products is a strategic pathway to sustainable food systems, especially in the Asian context, where food security and resource efficiency are still major challenges (FAO & UNICEF, 2021). As a member of ASEAN, the Philippines has pledged to reach the SDGs by 2030, including the reduction of food waste and the enhancement of nutrition for the most vulnerable segments of society. The Philippine poultry sector produces about 1.63 million metric tons of chicken annually, and chicken feet are a significant part of poultry by-products that are not fully utilized in the local market (United States Department of Agriculture Foreign Agricultural Service, 2025).

The technical merits of using chicken feet for processed meat are convincing due to their distinctive compositional traits, which make them suitable for valorization. The connective tissue in chicken feet contains a high content of Type I collagen (approximately 20–25 percent of the total weight) and offers unmatched water-binding and gel-forming qualities that are essential for stabilizing meat emulsions (Araujo et al., 2018; Santana et al., 2020). During thermal processing, collagen undergoes controlled denaturation and partial conversion to gelatin to create a thermally reversible gel network, adding desirable texture, moisture, and sliceability to processed meat products (Hashim et al., 2014).

The amino acid profile of chicken feet, rich in proline, hydroxyproline, and glycine, not only enhances gel strength but also offers potential health benefits associated with collagen intake, such as supporting joint health and maintaining skin integrity (Araujo et al., 2019). These functional properties make chicken feet a valuable source of protein and a natural texture modifier that can effectively reduce the need for synthetic binding agents and lower the fat content in luncheon meat formulations.

In addition to the functionality of chicken feet, arrowroot flour is an excellent starch-based binder because of its small particle size, neutral flavor, and excellent gel clarity compared to other conventional starches. The digestibility coefficient of arrowroot (>95%) and its gluten-free status align with the current clean-label trend and it also provides vital minerals such as potassium and iron. The synergistic effect of combining collagen-derived gelatin with arrowroot starch creates a dual-binding system that not only enhances textural properties but also increases nutrient density.

When developing processed meat products based on chicken feet, food safety procedures must be taken into account, mainly because the microbiological hazards of poultry by-products are well known, as is the high moisture content of the final product, which is typically present in collagen-rich formulations. Chicken feet must be processed following Hazard Analysis Critical Control Points (HACCP) guidelines, particularly ensuring the adequacy of thermal treatment, control of pH, and water activity to prevent the development of pathogens (FDA Philippines, 2022). Collagen-containing products have high intrinsic water activity, which requires either thermal sterilization followed by hermetic packaging or modified atmosphere storage to ensure microbiological safety and extend shelf life.

These regulatory compliance requirements, based on the Philippine Food Safety Act, require comprehensive product characterization, including nutritional labeling, allergen declarations, and shelf-life

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validation studies. The fact that chicken feet are a novel primary protein source in commercial luncheon meat may require additional documentation of procedures for product standardization and ensuring its safety for consumers.

Although the nutritional benefits of chicken feet are well known and interest in sustainable protein sources is increasing, little systematic research has been conducted on using chicken feet in standardized processed meat products. While chicken feet have been used in traditional Asian cuisines for many years, their use in Western-style processed meat products like luncheon meat has not been extensively studied through food science approaches. Existing literature mainly focuses on collagen extraction and purification rather than on using the whole tissue in ready-to-eat products.

In the current market, alternative protein luncheon meat products mainly consist of plant-based substitutes or traditional meat combined with vegetable protein, and there is significant potential for the valorization of animal by-products. The absence of commercial chicken feet luncheon meat products in Philippine markets, despite the country's large poultry industry and high processed meat consumption, indicates a market opportunity for such an innovation.

Furthermore, studies on consumer acceptance factors for by-product-derived processed meats are lacking in Southeast Asian settings, where traditional consumption patterns can influence product adoption differently compared to Western markets. Understanding these acceptance dynamics is essential for the successful commercialization of newly developed processed meat products.

To fill this gap, the research will develop a chicken feet-based luncheon meat and characterize it to maximize the functional benefits of collagen and meet modern consumer demand for healthier, more sustainable alternatives to processed meat products. This research supports the development of sustainable food systems by demonstrating the feasible valorization of poultry by-products, which could help reduce industry waste and generate economic value.

The process of incorporating chicken feet and arrowroot flour represents a novel approach to food formulation within processed meat, serving as an example of a similar valorization strategy in the meat processing industry. This research will lay the groundwork for commercial development and regulatory approval by providing a comprehensive quality assessment, including microbiological safety, physicochemical properties, nutritional content, and consumer acceptability.

The expected results include demonstrating the technical feasibility, identifying key processing parameters, and assessing the nutritional benefits of the product compared to traditional luncheon meats. The study also aids in understanding consumer acceptance factors for innovative processed meat products in developing markets in general.

Objectives of the Study

This study aimed to develop luncheon meat from chicken feet.

Specifically, this study sought to achieve the following objectives:

1. Identify the processes involved in making chicken feet luncheon meat.
2. Evaluate changes in the quality properties of chicken feet luncheon meat in terms of:
   2.1 Yeast and mold count;
   2.2 Moisture content; and
   2.3 Water activity.
3. Evaluate the level of consumer acceptability of chicken feet luncheon meat in terms of:
   3.1 Appearance;
   3.2 Aroma;
   3.3 Taste; and
   3.4 Texture.
4. Compare chicken feet luncheon meat with similar existing products in the market in terms of:
   4.1 Nutritive value; and

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4.2 Cost.

Literature Review

Luncheon Meat

Pre-cooked or cured processed meat, commonly called luncheon meat, has become a staple in many Filipino households. This trend has fueled the growth of the global canned luncheon meat market, which is expected to reach around USD 32.49 billion by 2025 (Agriculture and Agri-Food Canada, 2023; Market Research Intellect, 2025). The widespread popularity of processed meat products is linked to consumer demand for convenient food options within sustainable food systems (Golloso-Gubat, 2024). The Department of Trade and Industry reports that the Philippine processed meat industry comprises six categories: fresh processed meat, cured meat pieces, raw-cooked products, pre-cooked products, raw (dry) fermented sausages, and dried meat (Department of Trade and Industry - Board of Investments, n.d.). In the Philippines, luncheon meat, along with sausages, corned beef, and bacon, is a significant export product in the processed meat sector (Agriculture & Agri-Food Canada, 2023).

Pork luncheon meat, often called spam or luncheon meat, is a popular processed meat product worldwide. It is typically made as a processed meat emulsion containing about 30-35% lean pork, 20-24% fat, 30-35% water, and 1.8-2.0% salt, along with various additives like sugar, phosphates, stabilizers, and seasonings (Goethals et al., 2020; Ng, 2017). This recipe is standard in commercial products, which usually include pork (around 72%), water, salt, sugar, potato starch, and spices as their main ingredients (Ng, 2017; Food and Drug Administration, 2023). The most well-known brand is SPAM, produced by Hormel Foods Corporation since 1937.

To address consumers' health concerns, the global processed meat industry is developing alternative options, such as nitrate-free products with plant-based substitutes like parsley extract powder (Zhang et al., 2023; Shakil et al., 2022), and healthier choices like organic deli meats and protein-enriched snacks to meet changing dietary preferences (Gupta, 2025). These innovations show the industry's effort to eliminate harmful additives, such as nitrites, without sacrificing quality or safety (Shakil et al., 2022). Recent trends include the rising popularity of entirely plant-based luncheon meats in markets like the Philippines (Pagulayan et al., 2024), as well as hybrid meat products that combine traditional animal proteins with plant-based ingredients to boost nutrition and appeal (Grasso, 2024; Baune et al., 2023). Overall, these advances mark significant progress in alternative protein technology, addressing the growing demand for sustainable and health-focused foods.

Luncheon Meat Processing

Luncheon meat processing involves several key steps to ensure safety, quality, and shelf stability. It usually starts with selecting appropriate meat cuts, such as mechanically separated poultry and pork, which are processed by crushing bones and pushing tissues through screens under high pressure to create a paste-like consistency for further processing (Zhang et al., 2017; Tenafranca, 1984). This mechanical separation, along with standard meat processing techniques, is essential for achieving a uniform texture in processed meat, both in the Philippines and around the world (Pereira & Vicente, 2013). The process also includes grinding and mincing muscle tissue to reduce particle size and emulsifying fats and water to form a stable mixture, which is then shaped into the final product with specific texture features (Lee et al., 1981; Pearson & Gillet, 1996).

Today, processed meat production, such as luncheon meat, uses advanced vacuum packaging technology that creates oxygen-free environments, helping to preserve quality and significantly extend shelf life (Soro et al., 2021; Kowalczyk et al., 2024). These vacuum systems not only protect the product but also improve distribution efficiency by up to 28 percent for medium- and long-distance transport. Additionally, active packaging innovations are ongoing to meet consumer preferences and market demands (Li et al.,

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2022). Proteins play a vital role in processed meat, especially in emulsion formation and stability, with myofibrillar proteins acting as emulsifiers. They interact with fat and water phases through hydrophobic and hydrophilic regions, forming a stable protein network that influences the final texture of ground meat products. Recent fat reduction methods highlight the importance of protein-based emulsification systems in maintaining technological and sensory qualities while improving the nutritional profile of meat products (Pintado & Delgado-Pando, 2020).

The main control point in processed meat production is thermal processing, usually achieved through a combination of temperature and time (70-75℃ for longer durations or higher temperatures for shorter periods). This method ensures pathogen reduction, microbiological safety, and preserves both sensory and nutritional qualities (Bhat et al., 2021; McMinn et al., 2018; Hassoun et al., 2020). Thermal processing of muscle foods primarily aims to improve palatability and sensory qualities while also ensuring safety (Ingham, 2009). The specific parameters depend on the target microorganisms and the desired food characteristics. Processed meat is canned by filling hot meat mixtures into sterile cans in sterile conditions, sealing them under vacuum, and then applying thermal sterilization. During this process, the product's center reaches approximately 121℃, with F-values of 4-6 minutes, to achieve commercial sterility (Food and Agriculture Organization of the United Nations, n.d.). Combining this thermal method with vacuum packaging effectively extends the shelf life of canned meats without degrading their quality (Yang et al., 2022; Wang et al., 2019).

In processed meat production, quality control involves monitoring pH levels and water activity (aw <0.85 as per FSIS shelf-stability standards). Microbiological tests, including checks for yeasts and molds, are also conducted because water activity above 0.95 promotes the growth of microorganisms such as bacteria, yeasts, and molds (Barbosa-Canovas et al., 2008; Buchanan et al., 2018). These critical control points ensure product safety and stability by preventing the growth of pathogenic and spoilage microorganisms during manufacturing (Rahman, 2020). The meat industry is increasingly working to reduce salt content in processed meats, and researchers aim to develop methods to achieve this without sacrificing sensory qualities (Desmond, 2006; Gaudette et al., 2017). Current strategies depend on the matrix, as the success of salt substitutes and flavor enhancement techniques varies with meat formulation and processing conditions (Inguglia et al., 2017; Gaudette et al., 2017).

Chicken Feet as Raw Ingredient for Food Production

Chicken feet consist of skin, cartilage, tendons, and bones. They are high in collagen, making up 70-72% of the total protein and approximately 56% of the dry weight (Dhakal et al., 2018; Araujo et al., 2018). Although they contain little meat, chicken feet are nutritionally and industrially valuable because of their rich collagen content. In food processing, they are used to extract collagen and bioactive compounds, with their shape and size varying depending on breed, age, and rearing conditions (Woo et al., 2023; Mabelebele et al., 2017). Poultry by-products like these have potential in food formulations and nutraceuticals due to their unique composition (Akimova et al., 2023). The scientific name Gallus gallus domesticus is the official term for the domestic chicken. However, locally in the Bicol Region, they are called “Adidas,” while in other parts of the Philippines, they are known as “Paa ng Manok.”

The structure of chicken feet comprises tendons, skin, and cartilage, with minimal muscle tissue, making them suitable for research in flexor tendon surgeries (Vamhidy et al., 1995). They are a rich source of structural proteins, with collagen making up about 70-71% of their total protein content. This quality makes them an excellent raw material for extracting gelatin and producing functional foods (Zhou et al., 2016; Santana et al., 2020; Potti & Fahad, 2017). The collagen from connective tissues and cartilage in chicken feet has turned this poultry by-product into a valuable source of collagen-based biomaterials and food ingredients (Santana et al., 2020).

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Nutritional Value

Collagen is a structural protein that gives shape, strength, and protection to your skin, tendons, muscles, bones, and ligaments, making up about 70 percent of their total protein content. Chicken feet are a poultry by-product that contains 19.4g of protein and 14.6g of fat per 100g, serving as a valuable source of collagen and bioactive compounds (Santana et al., 2020; Liu et al., 2001). Due to their high protein content and collagen-rich structure, chicken feet are an important alternative protein source with potential uses in the food industry (Mokrejs et al., 2017).

Chicken feet were extracted at 100℃ in hot water for 8 hours, resulting in a collagen content of 13.9 g per 100 g. The percentage of low-molecular-weight collagen with higher levels of proteolytic enzymes increased accordingly (Woo et al., 2023). Seasoned papain-based enzymatic hydrolysis produced optimal collagen yields of 32.16% (w/w) from chicken feet after 28 hours of incubation at 30℃, with glycine (16.30%), hydroxyproline (14.15%), and proline (8.70%) as the main collagen components, along with varying molecular weight distributions (Dhakal et al., 2018). These findings suggest the potential to valorize chicken feet as a by-product of the poultry industry for collagen extraction and biomedical applications (Zhou et al., 2016; Santana et al., 2020).

Chicken feet, besides being rich in collagen, are also high in proteins (77.59 ± 2.05 g/100g dry basis), with collagen making up about 72.5% of the total protein in chicken feet (Santos et al., 2018). The collagen in chicken feet is mainly type I and contains amino acids like proline and hydroxyproline, which help with water retention and emulsifying properties (Liu et al., 2001; Hashim et al., 2014; Araujo et al., 2018). The collagen content is exceptionally high, with approximately 70.90% of the total protein being collagen that contains 99.44% of the essential nutrients needed for human health (Santana et al., 2020). Enzymatic hydrolysis methods have been used to improve the extraction and analysis of low-molecular-weight collagen from chicken feet, showing potential for developing collagen-based functional food products (Woo et al., 2023; Liu, 2001).

Chicken feet are a rich source of protein, mainly collagen, and an important component that supports connective tissues like cartilage, tendons, and ligaments. The dry matter of chicken feet contains about 56 percent collagen, mainly type I, and shows functional properties such as water retention and heat stability (Araujo et al., 2018). Additionally, type II collagen from chicken cartilage has been proven to benefit joint health and reduce joint pain in clinical trials (Lugo et al., 2013). Collagen extracted from chicken feet looks promising as a functional food ingredient; however, the direct effects of chicken foot collagen on flexibility and joint health are still unclear and need more research (Woo et al., 2023).

Chicken feet collagen produced through optimized extraction yielded over 8 percent and had a protein content of 78.525 g/100 g (Santana et al., 2020), while raw chicken feet contained 77.592 g/100 g of protein, with collagen making up 72.5% of the total proteins (Araujo et al., 2018). Other studies reported gelatin production of 7.06-7.93% in chicken feet, with protein concentrates ranging from 82.53 to 85.92% (Liu et al., 2001). The food industry has recognized chicken feet as a valuable by-product for extracting high-quality collagen and gelatin, which are used in biofilm production and to enhance food processing, with consumer acceptance rates exceeding 80% compared to commercial gelatin (Zhou et al., 2016; Santana et al., 2020).

Using chicken feet as a source for collagen extraction has become valuable because they contain about 70.90 percent of the total protein. Studies have explored ways to improve the process of extracting and characterizing collagen for creating collagen-rich products (Araujo, 2018; Hashim et al., 2014; Woo et al., 2023). Thanks to their high collagen content, chicken feet are increasingly seen as a sustainable by-product for producing high-quality gelatin and bioactive compounds for functional foods (Santana et al., 2020). The bioactive properties, such as antihypertensive and antioxidant effects, of chicken feet protein hydrolysates have been confirmed, supporting their use in nutraceutical development (Mas-Capdevilla et al., 2019; Susanto et al., 2018).

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Nutritional Content and Physicochemical Properties

The nutritional makeup of processed meat products, especially luncheon meat, differs significantly from fresh meat due to added ingredients like salt, water, lipids, and other additives used during processing (Agarwal et al., 2015; Maky et al., 2020; Goethals et al., 2020). These processing methods and ingredients lead to luncheon meat with higher sodium content, increased protein, and altered oxidative patterns compared to raw meat. Despite these changes, they still provide essential amino acids, vitamins, and minerals (Agarwal et al., 2015; Maky et al., 2020; Goethals et al., 2020). The composition of traditional luncheon meat varies widely depending on the formulation and manufacturing process, with research indicating broad variations in moisture, protein, fat, and carbohydrate levels among products (Abdullah, 2007; Goethals et al., 2020). Evidence shows that commercial luncheon meat typically contains 12-18% protein, 15-25% fat, 55-65% moisture, and 2-4% carbohydrates, although these figures can fluctuate based on raw material quality, fat replacers, and production techniques (Abdullah, 2007; Khalil et al., 2020).

Processed meat production significantly affects water activity (aw), which is usually kept below 0.85 to prevent the growth of harmful bacteria, as these bacteria typically need a water activity of at least 0.91 to survive (Tapia et al., 2020). However, for refrigerated luncheon meats with higher water activities (above 0.95), proper handling and storage after packaging are essential because these conditions can promote microbial growth and threaten product safety (Rahman, 2020).

The microbiological quality standards for processed meat products typically include total plate count limits of less than 106 CFU/g, with research also showing that initial microbial levels should range between 4.30 and 6.79 log CFU/g depending on storage conditions. Additionally, these products must be free of pathogenic bacteria such as Salmonella and Listeria monocytogenes (Lemos Junior et al., 2024). Moreover, yeast and mold populations, particularly genera like Trichosporon and Candida, are key spoilage indicators that need to be monitored and controlled in vacuum-packaged processed meats (Lemos Junior et al., 2024; Ranucci et al., 2019). Recent studies demonstrate the critical importance of continuously monitoring essential parameters such as microbial load, storage temperature, water activity, and pH throughout the shelf life of processed meat products to ensure microbiological safety, maintain product quality, and accurately determine shelf life (Katsaros & Taoukis, 2021; Lemos Junior et al., 2024; Ntzimani et al., 2025).

The inclusion of alternative protein sources like chicken feet and functional ingredients such as arrowroot flour can significantly change the nutritional profile of luncheon meat products. Chicken feet have a high potential as a source of food-grade collagen; their collagen content is approximately 72.5% of the protein, with a total collagen amount of 56.31 ± 1.98 g per 100 g on a dry weight basis (Araujo et al., 2018). The functional properties of collagen isolates derived from chicken feet include high water retention and emulsifying activity, presenting opportunities for their use in the food industry (Araujo et al., 2018; Hashim et al., 2014). Processing chicken feet enhances the amino acid profile, especially increasing the levels of proline and hydroxyproline up to 20.66 percent in collagen isolates, which optimizes thermal stability and hydrogen bonding potential in meat products (Hashim et al., 2014; Liu et al., 2001; Araujo et al., 2018).

Physico-chemical properties, including texture, color, and emulsion stability, are essential for consumer acceptance. Chicken feet are rich in collagen, which can be extracted as collagen gel and effectively used as a fat replacer in chicken sausages, improving their quality characteristics during refrigeration. It also enhances the physicochemical properties of other meat products (Araujo et al., 2021; Araujo et al., 2019). Studies have demonstrated that adding chicken feet collagen to low-fat processed meat systems helps preserve product quality and may improve textural and functional traits in some formulations compared to conventional options (Araujo et al., 2019). Researchers have shown that collagen derived from chicken feet can boost the texture properties and quality parameters of processed meat products such as sausages and forcemeat formulations (Santana et al., 2020; Akimova et al., 2023; Araujo et al., 2021).

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There has been a recent movement toward studying natural alternatives to synthetic sodium nitrite in processed meat products, and celery powder is a potentially useful source of naturally occurring nitrates that may provide antimicrobial effects and help preserve the color of cured meat products (Alahakoon et al., 2015; Sindelar & Milkowski, 2012). Research shows that natural antimicrobials, such as plant-derived nitrate sources, can control pathogenic bacteria like Listeria monocytogenes in ready-to-eat processed meats, meeting consumer demand for clean label ingredients (Xi et al., 2011). This approach aligns with current consumer preferences for clean-label products with minimal artificial additives.

METHODS

Research Design

The study focused on developing Chicken Feet Luncheon Meat. The research and development (R&D) and descriptive methods were used to evaluate the product's acceptability based on appearance, aroma, taste, and texture. Responses were collected and analyzed to assess how acceptable the product is. The research development process (R&D) involved planning, product development, validation, and revision. The experimental method was used to determine the most suitable formulation and processes involved in developing Chicken Feet Luncheon Meat.

Planning

The first and most crucial part of the planning stage determined the sequence of procedures and the research approach before constructing the study. It involved integrating ideas, gathering relevant data and information, and analyzing the collected data.

The researcher decided to study chicken feet because of their nutritional content and their uniqueness as a raw material that could be used as a main ingredient in developing food products. To explore their health benefits, the hard outer layer of skin was removed, and the meat was formulated into luncheon meat combined with other ingredients to test whether it could enhance the product's nutritional content. The researcher gathered information from existing literature and studies related to luncheon meat preparation and the raw materials used, such as deboned chicken feet and arrowroot flour.

Product Development

This stage focused on preparing Chicken Feet Luncheon Meat following the standard procedure. The researcher conducted trials to find the most suitable method for making luncheon meat based on the gathered information. This stage involved identifying the materials and steps required to produce Chicken Feet Luncheon Meat. It involved preparing the deboned chicken feet and then making the Chicken Feet Luncheon Meat.

Preparation of the Chicken Feet Luncheon Meat

Several kitchen tests were conducted using different ingredients in luncheon meat production to identify the initial formulations and processes for making Chicken Feet Luncheon Meat. These include cleaning, soaking, deboning, weighing, blending, molding, curing, canning, cooling, and labeling. Figure 1 illustrates the process flow for preparing Chicken Feet Luncheon Meat.

The tests were conducted using various ingredients commonly found in luncheon meat production, such as meat water, salt, nitrites, and others, until they developed a formulation suitable for luncheon meat. The modifications were trialed to achieve the desired quality of the Chicken Feet Luncheon Meat. Each trial was carefully documented and observed until the optimal recipe was identified.

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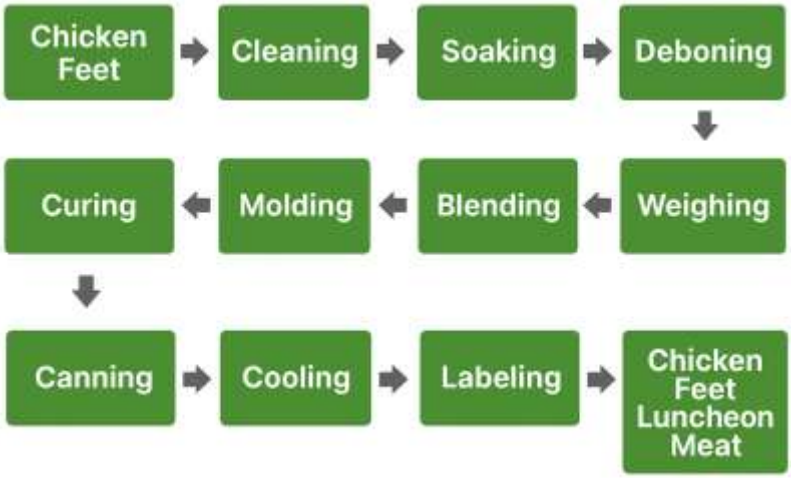

Figure 1. *Flow Chart for the Preparation of Chicken Feet Luncheon Meat*

Trials and Modification

The Chicken Feet and Luncheon Meat underwent three (3) trials to determine the best formulation in terms of appearance, aroma, taste, and texture. The trials involved sensory evaluation, which was participated in by ten (10) SHS TVL/Cookery students, ten (10) T.L.E. teachers of Rodriguez National High School, and ten (10) potential consumers such as parents, vendors, out-of-school youth, and unemployed households within the vicinity of Cadlan, Pili, Camarines Sur.

A total of three trials were conducted, with trial three (3) rated as the most acceptable and endorsed for further food laboratory testing. To achieve a highly acceptable result, the ingredients were carefully prepared with a strong focus on sanitation. The first trial, which used 100 grams of chicken meat, resulted in a texture that was too gelatinous, and the binding was inconsistent. In trial 2, adjustments were made by optimizing the fat-to-meat ratio. Adding 150 grams of arrowroot flour still caused the luncheon meat to lack that dense, cohesive feel.

In the final trial, white meat was added at a ratio of 50 grams to achieve a better balance of savory and saltiness. These progressive modifications resulted in a well-balanced, firm yet tender luncheon meat with improved flavor and stability, leading to the most desirable trial. The most acceptable trial was subjected to microbiological and nutritional analysis to ensure the product's safety from spoilage and disease-causing microorganisms and its health benefits. Table 1 shows the three trials conducted to prepare Chicken Feet Luncheon Meat, which were served as samples for the sensory evaluation.

Table 1. Trials Conducted in the Preparation of Chicken Feet Luncheon Meat

Ingredients	Trial 1	Trial 2	Trial 3
300 g ground chicken feet	**Findings:**	**Findings:**	**Findings:**
100 g white meat	Texture may be too gelatinous or firm.	Texture improved but remained slightly inconsistent.	The appearance, aroma, mouthfeel, and taste all achieved highly acceptable results in the evaluation.
100 g arrowroot flour	Flavor balance may need adjustments.	Taste improved but may require further adjustments in savory flavor or salt balance.	
8 g ground garlic	Binding issues due to collagen content.	Some separation in the mixture was noticed during cooking.	A firm yet tender luncheon meat with improved flavor and stability was identified.

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6.3 g brown sugar			
9 g rock salt			
15 g white pepper			
15 g cold water	**Modifications:**	**Modifications:**	
5 g pink salt	The amount of ground chicken feet was increased to 100 grams.	The amount of deboned chicken feet was decreased to 100 grams.	

Based on the sensory results and the evaluation of appearance, aroma, mouthfeel, and taste, which included consumer acceptability, trial three was rated as "highly acceptable," making it the most suitable formulation for laboratory analysis and consumer acceptability testing. The most acceptable trial produced a smooth yet firm product with improved texture and flavor.

Evaluation of the Chicken Feet Luncheon Meat

The Chicken Feet Luncheon Meat evaluation involved two stages: the Sensory Evaluation and the Consumer Acceptability assessment. A survey questionnaire complemented the study to identify its sensory features and acceptability. The evaluation tools were distributed to the selected evaluators for each stage. The levels of acceptability in terms of appearance, aroma, taste, and texture were recorded and calculated using the weighted mean of individual respondent scores.

The first stage was the Consumer Acceptability evaluation, where the product was rated based on consumer acceptance and preference regarding appearance, aroma, mouthfeel, taste, and overall acceptability, as perceived by the identified evaluators. Participants included ten (10) SHS TVL/Cookery students, ten (10) T.L.E teachers from Rodriguez National High School, and ten (10) potential consumers such as parents, vendors, and out-of-school youth. Table 2 presents the Scale of Interpretation for Consumer Acceptability of the Chicken Feet Luncheon Meat, which was administered to all respondents to validate the study.

The final trial involved microbiological and nutritional analysis tests. The microbiological test was conducted to ensure the product was free from disease-causing microorganisms. It also underwent physicochemical analysis to examine the physical properties and changes of Chicken Feet Luncheon Meat. These tests were performed to ensure the product is safe for consumption. The testing took place at the Food Testing Laboratory of the Central Bicol State University of Agriculture, San Jose, Pili, Camarines Sur. After confirming the product was clean and safe through initial lab testing, it was then subjected to nutritional composition analysis to determine its nutritional content, including the macronutrient values of the Chicken Feet Luncheon Meat. Table 2 shows the interpretation scale for the sensory characteristics of the Chicken Feet Luncheon Meat, along with their descriptive equivalents.

Table 2. *Scale of Interpretation for Sensory Characteristics of the Chicken Feet Luncheon Meat*

Scale	**Verbal Interpretation**			
	Appearance	**Aroma**	**Taste**	**Texture**
4.51–5.00	Highly Acceptable	Highly Acceptable	Highly Acceptable	Highly Acceptable
3.51–4.50	Acceptable	Acceptable	Acceptable	Acceptable
2.51–3.50	Moderately Acceptable	Moderately Acceptable	Moderately Acceptable	Moderately Acceptable
1.51–2.50	Slightly Acceptable	Slightly Acceptable	Slightly Acceptable	Slightly Acceptable

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1.00–1.50	Unacceptable	Unacceptable	Unacceptable	Unacceptable

Statistical Treatment

For the statistical treatment, the data were gathered and use the formula below to get the average weighted mean of the result. To get the mean, this equation was used:

Where:
Average weighted mean
w = frequency
n = total number of evaluators
x = rating

Final Product

The study underwent several trials to develop the most acceptable formulation and processes involved in preparing Chicken Feet Luncheon Meat. It involves two stages of preparation: making arrowroot flour and the preparation of luncheon meat. The recipe below presents the most acceptable formulation for the Chicken Feet Luncheon Meat.

Chicken Feet Luncheon Meat

Raw Materials:

300g Ground Chicken Feet
100g Chicken Meat
100g Arrowroot flour
8g Ground garlic
6.3g Brown sugar
9 g Rock salt
15 g White pepper powder
15 g Water



Figure 2. *Chicken Feet Luncheon Meat Label*

Procedures:

When preparing chicken feet luncheon meat, the researcher first gathered and weighed all ingredients. The chicken feet were cleaned, boiled, carefully deboned, and ground into a fine paste. Then, the mixture was combined with the right ratio of chicken, binders like arrowroot flour, and seasonings such as salt, white pepper, ground garlic, brown sugar, rock salt, pink salt, and water to improve texture and flavor. This was followed by emulsification through controlled mixing to create a smooth, cohesive consistency. The blended mixture was then molded into casings or cans, cured, and cooked in a pressure canner at a precise temperature to ensure proper binding and stability while preventing separation. The product was then allowed to cool. It was subsequently packaged, sealed, and labeled. One recipe yielded two cans of chicken feet luncheon meat, each weighing 300 grams.

Food Cost

This presents the summary of expenditures for the ingredients, packaging, materials, and all other expenses incurred in the production of Chicken Feet Luncheon Meat. The ingredients amounted to ₱86.09.

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Table 3. *Food and Material Cost per Chicken Feet Luncheon Meat*

Item	Quantity Used	Purchase Price (₱)	Unit Cost (₱)	Total Cost (₱)
Materials				
Ground Chicken Feet	300 g	45.00/kg	13.50	13.50
Arrowroot	100 g	180.00/kg	18.00	18.00
Flour	50g	35.00/kg	1.75	1.75
White Meat	50g	220.00/kg	11.00	11.00
Rock Salt	10g	25.00/kg	0.05	0.05
Pink Salt	5g	450.00/kg	0.23	0.23
White Pepper Ground	5g	850.00/kg	0.43	0.43
Garlic	5g	180.00/kg	0.09	0.09
Brown sugar	1tbsp	65.00/kg	0.49	0.49
Cold Water	¼ cup	35.00/gal	0.55	0.55
II. Packaging and Label				
Label	1	12.00/pc	12.00	12.00
Tin Can	350g	25.00/pc	25.00	25.00
Shrinkable Plastic	1	3.00/pc	3.00	3.00
			TOTAL:	₱86.09

Note. Costs and totals are reproduced as reported; ingredient quantities and unit-cost calculations require verification.

Presented above is the computation of the selling price of the Chicken Feet Luncheon Meat using a 60% mark-up rate. The total production cost of the product, amounting to ₱86.09, was multiplied by the mark-up percentage (0.60), resulting in a mark-up value of ₱51.65. This mark-up represents the additional amount added to the production cost to ensure profitability. To determine the final selling price, the computed mark-up was added to the total cost. Thus, ₱86.09 + ₱51.65 resulted in a revised selling price of ₱137.74 per can of Chicken Feet Luncheon Meat.

Materials

This study used different ingredients, tools, and equipment used in making Chicken Feet Luncheon Meat, along with its functions and descriptions of how it is used in the study. Table 4 shows the different ingredients used in making Chicken. Feet Luncheon Meat.

Table 4. *Ingredients in making Chicken Feet Luncheon Meat*

Materials	Function
	Deboned Chicken Feet It is the primary ingredient in Chicken Feet Luncheon Meat. Often regarded as waste, this part of the chicken is valued for its collagen content.

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	Arrowroot Flour It comes from the root of the arrowroot plant and is a gluten-free starch that promotes digestion and gut health. It is included in chicken feet luncheon meat to enhance its texture, flavor, and nutritional content.
	Rock Salt Rock salt functions as a flavor enhancer, improves texture, and serves as a natural preservative, helping to inhibit microbial growth in the product.
	White Pepper White pepper offers a subtle heat that doesn't alter the product's natural color, making it perfect for light-colored meat dishes.
	Ground Garlic Ground garlic enhances aroma and flavor while serving as a natural antimicrobial.
	Brown Sugar Brown sugar contributes to a distinctive aroma and flavor.
	Cold Water Using cold water preserves the meat's firmness and juiciness, while also ensuring that curing ingredients are evenly distributed.
	White Meat White meat acts as the main protein source and the primary structural element of the product, offering texture and nutritional advantages.
	Pink Salt Pink salt functions as a curing agent that preserves meat by inhibiting bacterial growth, enhances its flavor, and maintains its attractive pink hue after processing.

Table 5 displays the tools and equipment used to prepare Chicken Feet Luncheon Meat. It is organized from the preparatory tools to the equipment required to produce the product. It includes descriptions and functions of each tool and piece of equipment.

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Table 5. *Tools and equipment used in making Chicken Feet Luncheon Meat*

Tools and Equipment	Function
	Measuring Spoon The measuring spoon accurately measures both dry and liquid ingredients to maintain recipe consistency.
	Weighing Scale The weighing scale accurately measures ingredients by weight, essential for maintaining product consistency.
	Stainless Spatula The stainless spatula is designed for mixing, folding, and scraping ingredients during preparation, all while maintaining the product's quality.
	Chopping Board The chopping board acts as a hygienic surface for cutting and preparing raw ingredients, helping prevent contamination and keep things clean.
	Kitchen Knife The kitchen knife is utilized for cutting, slicing, and chopping ingredients into uniform pieces required for preparation.
	Mixing Bowl The mixing bowl functions as a container for combining and blending ingredients during cooking.

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	Rubber Scraper The rubber scraper effectively scrapes, folds, and transfers mixtures, helping to minimize ingredient waste.
	Measuring Glass The measuring glass helps precisely measure liquid ingredients to ensure proper proportions in the recipe.
	Colander A colander is used to remove excess liquid or water from ingredients such as meat and vegetables while preparing them.
	Food Processor The food processor is designed to grind, chop, and process meat and other ingredients into finer textures suitable for product formulation.
	Pressure Canner A pressure canner is employed to sterilize and process canned meat products using high pressure, which guarantees food safety and extends shelf life.

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	Tin Can The tin can function as the primary container for the luncheon meat, shielding it from contamination and extending its shelf life.
	Chicken Feet Luncheon Meat label The chicken feet luncheon meat label is designed to convey the product's identity, enhance brand recognition, and present key information to consumers.
	Shrinkable Plastic Seal The shrinkable plastic seal secures and safeguards the tin can, maintaining product integrity and providing tamper evidence.
	Hot air heat gun dryer The blower produces heat to melt and shrink the plastic seals onto the tin can, ensuring the packaging is secure.

RESULTS



Figure 3. *The Chicken Feet Luncheon Meat*

The production of luncheon meat made from chicken feet presents a novel solution for the valorization of poultry by-products, addressing current consumer needs for healthier processed meat products.

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Additionally, the chapter presented a comparative study of existing commercial luncheon meat products in the market to determine the competitive positioning and nutritional benefits of chicken feet–based formulations. The findings demonstrated the potential to convert the traditional low-value poultry by-product, chicken feet, into a nutritionally viable product with distinct protein qualities, characterized by high collagen content and extremely low fat content compared to common alternatives. This research presented the basis for potential commercialization and, at the same time, highlighted critical issues in optimizing the product, preservation methods, and market positioning as the health-conscious consumer environment continues to evolve.

Developing chicken feet luncheon meat provided a strategic approach to enhancing protein utilization and bolstering food security in the Philippines. This novel processed meat product involved carefully deboning chicken feet, which are typically considered low-value by-products in the Philippine poultry sector, despite their high collagen content and nutritional benefits. The product development process involved manually deboning chicken feet and then adding complementary ingredients such as binding agents, emulsifiers, seasoning blends suited to Filipino taste preferences, and preservatives that met Philippine food safety standards (FDA-approved under Administrative Order No. 2004-0009). The formulation was optimized to achieve the desired texture, increase protein content, and maintain affordability for the Filipino market. Given the rising demand for affordable protein in the Philippines and the cultural acceptance of chicken products, this development addressed both economic sustainability in poultry processing and nutritional accessibility. Chicken feet, which are high in collagen (approximately 60–70% of the total protein content), helped create the gel-like texture needed for luncheon meats and provided functional amino acids often absent in traditional processed meats.

The final product was packaged following strict protocols, employing vacuum-sealed, multi-layer materials designed for the tropical climate typical of the Philippines. Thermal processing adhered to HACCP guidelines, with critical control points monitored to ensure pathogen elimination, achieving commercial sterility with appropriate F_0 values for low-acid foods. Quality assurance included microbiological tests, sensory evaluations reflecting Filipino consumer preferences, and shelf-life studies conducted under accelerated conditions that simulated distribution channels in the Philippine market.

This innovation has the potential to transform underused poultry by-products into valuable protein sources, thereby aiding food security and promoting sustainable waste management in the Philippine food processing sector.

Processes Involved in Making Chicken Feet Luncheon Meat

The preparation of chicken feet luncheon meat was a careful, multi-step process that started with sourcing fresh chicken feet from a reliable supplier to ensure quality. The steps involved in making chicken feet luncheon meat included gathering the chicken feet, cleaning, soaking, deboning, weighing, blending, molding, curing, canning, cooling, and labeling.

Preparation of Raw Ingredients

The process began with the cleaning of chicken feet, where the raw materials were carefully cleaned under cold running water and scraped to eliminate visible dirt and impurities. This step was essential because initial cleaning significantly reduced microbial load and prevented contamination during further processing, as indicated by recent studies on meat sanitation and shelf-life control (Medvix Publications, 2024). The implication of this procedure was the increased safety and quality of the raw material, aligning it with mandated cleanliness standards in meat processing companies.

To improve cleanliness and get rid of smells, the chicken feet were cleaned and then immersed in a vinegar and water solution for 30 to 40 minutes. Acidic soaking is recognized as a method for reducing microbial activity in raw meat, and vinegar has been widely recommended as a natural antimicrobial agent in modern preservation practices (Nisar et al., 2024). This indicated that the product became safer and more

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acceptable before deboning, linking the step to pre-treatment procedures routinely performed in meat preservation.

Deboning followed, with each chicken foot being deboned with a sharp knife to yield soft, edible tissue. This procedure was critical because deboning ensured improved texture, enhanced appearance, and a lower risk of undesirable components in the finished product. According to recent research on canned minced meat, precise deboning supports uniform product structure and improves blending quality (Processes, 2025). This phase resulted in a smoother mixture suited for emulsification, which was closely related to standard methods in processed meat manufacturing.

After deboning, the deboned chicken feet were measured to 300 grams and precisely mixed with 50 grams of arrowroot flour, 5 grams of garlic, 6.3 grams of brown sugar, 10 grams of salt, 5 grams of pink salt, 5 grams of white pepper, and 15 grams of cold water. Next, an additional 50 grams of finely ground white meat (such as chicken breast) was incorporated to boost protein and create a smoother, cohesive texture, and the mixture was blended until fully integrated. The right combination of flavor, texture, binding power, and microbiological safety was ensured by proper ingredient composition. Salt and curing agents, for instance, served vital functions in inhibiting microbial growth and stabilizing cured color, as evidenced in recent studies on meat stability and safety (Foods Journal, 2022). This stage was linked to industry processes for processed and canned meats through the use of a defined formulation that ensured consistent results.

The next step was blending, which involved thoroughly mixing the mixture until it became consistent and smooth. Blending ensured correct emulsification, homogeneous distribution of curing salts, and improved product structure. According to studies on meat preservation, cold blending maintains the structural integrity of processed meats and prevents bacterial growth (Nisar et al., 2024). The implication of blending was the achievement of a homogeneous texture and improved sensory profile, relating this step to foundational procedures in creating quality luncheon meat.

The combined mixture was molded or formed into a uniform shape, allowing for efficient packaging and predictable heating during sterilization. Molding promoted consistent heat penetration, which was critical in preventing under-processing or texture discrepancies. Modern canned meat manufacturing research emphasizes the significance of uniform shape for safety and appearance (Processes, 2025). This process suggested improved product uniformity and was directly related to commercial luncheon meat manufacturing techniques.

The molded mixture was left to cure for 6–12 hours to allow for flavor development and complete absorption of curing salt. Curing also helped increase color stability and limit microbiological growth. Recent meat preservation literature demonstrates that curing remains an important practice even as new preservation technologies emerge (Springer, 2025). Curing ensured both safety and better flavor in the finished product, linking this procedure to long-standing meat curing practices.

After curing, the product was packed into cans, sealed, and sterilized at 121°C and 15 psi for 15–30 minutes. This sterilization technique eliminated hazardous microorganisms, including Clostridium botulinum, which is the principal issue with canned meat products. Research on canned chicken and pork shows that this temperature and pressure combination is necessary for safety and longer shelf life (Processes, 2025). The implication was that the technique produced a stable, safe, and commercially viable product that adhered to global canning standards.

Following sterilization, the cans were cooled to room temperature or refrigerated to maintain texture and prevent overcooking. Proper cooling preserved moisture content while preventing structural damage, which was critical for achieving optimal product consistency. Controlled cooling is essential for retaining texture and sensory quality, according to meat shelf-life studies (Medvix Publications, 2024). This stage indicated that the final product's structural integrity was improved, and it was closely related to thermal processing best practices.

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Lastly, each can was labeled with complete product information, such as the ingredients list, net weight, and nutritional content. Labeling was a crucial part of food packaging because it guaranteed consumer awareness, promoted transparency, and provided vital information required for safe consumption. Recent food safety recommendations emphasize that clear and accurate labeling promotes traceability, supports regulatory compliance, and strengthens consumer protection by preventing misinformation and misbranding. This suggested that accurate labeling not only increased consumer confidence but also ensured that the product was ready for market distribution and complied with established food safety regulations. Therefore, the labeling stage completed the transformation from a processed product to a compliant, marketable item by connecting the entire production process to the food industry's commercial and regulatory framework.

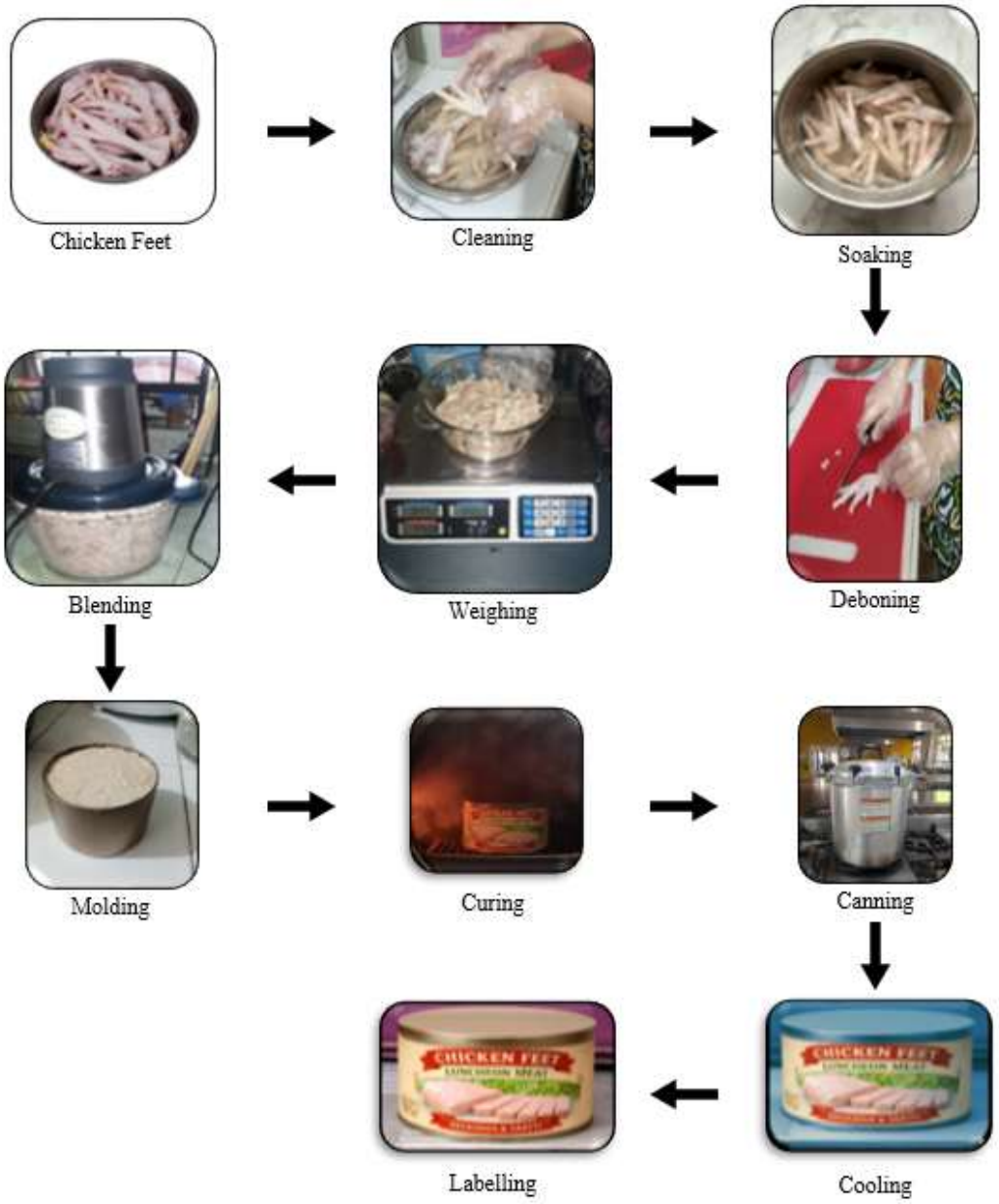

Figure 4. *Process flow of the Chicken Feet Luncheon Meat*

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Quality Change of Properties of Chicken Feet

Table 6. *Microbiological Analysis Results of Chicken Feet Luncheon Meat*

Parameter	Sample Code	Result	Method	Acceptable Limit*
Yeast and Mold Count	25-723-01	100 CFU/g	AOAC 997.02 Yeast and Mold Petrifilm Method	$\leq 10^3$ CFU/g

*Based on Philippine National Standards for processed meat products

The yeast and mold count of 100 CFU/g obtained in the results appeared acceptable for processed foods since manufacturers typically aim for less than 100 CFU/g as a quality benchmark; however, specific guidelines for processed meats needed to be verified against the Philippine FDA's current microbiological standards outlined in Circular 2022-012 (Food and Drug Administration, 2022). A low microbial load in the chicken feet luncheon meat suggested that manufacturing procedures were carried out effectively, including proper handling.

The low levels of yeast and mold present in the chicken feet luncheon meat indicated that it met microbiological safety standards, making it a potentially viable commercial option. Meat product development often involves utilizing specific processing techniques, such as strictly controlling storage temperatures and applying antimicrobial treatments, to reduce the presence of bacteria like Listeria monocytogenes and Salmonella enterica, thereby extending shelf life and protecting consumer health (Koutsoumanis et al., 2024; Zhang et al., 2025). Studies have suggested that specific handling factors significantly affect the shelf life of vacuum-sealed meats, such as the initial bacterial contamination level, moisture level, and storage temperature (Lemos Junior et al., 2024).

Recent breakthroughs in understanding contamination sources and innovative safety methods have shown that proper handling and processing of protein-based products can provide comparable microbiological safety to traditional meat products (Barcenilla et al., 2022; Rebezov et al., 2022; Sheng et al., 2021). Ensuring food safety by following set microbiological standards, along with proper heating and acidity regulation during food preparation, helps guarantee the quality of packaged processed foods by significantly minimizing microbial contamination (Food and Drug Administration, 2022). Research in multiple countries has demonstrated that proper processing techniques can dramatically reduce contamination in chicken feet products. In Brazil, studies have found that effective processing can reduce bacterial and pathogen counts, such as Salmonella (Santos et al., 2011). Similar results have been reported in Thailand, where properly processed and stored chicken feet products maintained acceptable levels of microorganisms (Zhang et al., 2025). Furthermore, poultry processing facilities across the region have validated their microbial safety standards (Maharjan et al., 2019).

Chicken Feet Luncheon Meat Quality Analysis

Table 7. *Physicochemical Properties of Chicken Feet Luncheon Meat*

Parameter	Value	Method Used
Moisture Content (%)	58.93	AOAC 925.10. Air Oven Method
Water Activity (%)	0.98	AOAC 979.11. Rotronics Water Activity Meter

Sample Information: Report No. 220150, analyzed on February 4, 2025

Moisture Content Analysis

Moisture content is one of the primary quality parameters that processed meat products must possess, as it directly influences the texture, shelf life, and microbial stability of these products. The water-holding capacity of the chicken feet luncheon meat was crucial to the product's manufacturing process and

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the safety of the food. The physicochemical analysis showed that the moisture content of the chicken feet luncheon meat was 58.93%, as determined through the application of the AOAC 925.10 Air Oven Method. This water content was within the acceptable range for processed meat products. It indicated a moderate moisture level, which means that the product was capable of retaining water during processing, a key factor in achieving juiciness and palatability. This result, however, needed to be interpreted with caution regarding preservation and storage. The water content of 58.93% suggested that the chicken feet luncheon meat would be juicy and tender. This relatively high amount of water content, however, required proper packaging and refrigeration**, otherwise the product could spoil.**

According to studies conducted on cooked chicken breast meat, the moisture content has been reported to vary between 70.36% and 74.3%, with differences occurring depending on the conditions used during cooking and processing (Noh et al., 2023; Hong et al., 2015). Research has also shown that the sous-vide cooking method is more effective in preserving moisture than traditional cooking methods. Raw chicken breast typically contains an average moisture content of approximately 74.3% before processing (Dominguez-Nino et al., 2020). The lower moisture content of chicken feet luncheon meat compared to whole-muscle chicken products could be attributed to the processing method and the unique composition of chicken feet, which are rich in collagen. Under national regulations, such as the Philippine National Standard for meat hygiene practices, processed meat products are subject to quality and safety requirements, including moisture content specifications (Department of Agriculture - Bureau of Agriculture and Fisheries Standards, 2015). Other recent studies have emphasized the importance of moisture control in maintaining the microbiological safety and quality requirements of vacuum-packaged and processed meat products throughout their shelf life (Lemos Junior et al., 2024).

Water Activity Assessment

The amount of available water in food is a crucial factor in preventing spoilage and foodborne illness, as it directly affects the ability of microorganisms to grow and enzymes to react. For certain processed meats, preserving microbial safety remains a top priority. During laboratory testing of the developed chicken feet luncheon meat, the results showed a high water activity level of 0.98, measured using the AOAC 979.11 method with a Rotronic Water Activity Meter. A water activity value of 0.98 indicates that the product contained a very high level of available water. The result exceeded the minimum levels required to support bacterial, yeast, and mold growth, indicating that the product was highly susceptible to spoilage and required proper preservation techniques to prevent contamination. With a water activity value of 0.98, the chicken feet luncheon meat was prone to microbial spoilage and thus required strict temperature control throughout the storage and distribution process. For long-term preservation, the developed product might require additional protection measures, such as proper packaging, refrigeration, and, in some cases, the addition of preservatives.

When the water activity in food products exceeds 0.95, it creates ideal conditions for the growth of bacteria, yeasts, and molds (U.S. Food and Drug Administration, 2014). Consequently, accurate microbiological evaluation is essential for ensuring the safety of processed foods, as mandated by regulatory guidelines (Food and Drug Administration Philippines, 2022). High moisture levels in food environments can facilitate the growth of hazardous microorganisms, making their elimination more difficult (Koutsoumanis et al., 2024). In tropical climates, such as those in the Philippines, where temperatures and humidity levels are often high, managing food temperature with real-time monitoring is essential for maintaining safety and preventing bacterial growth, particularly for high-risk foods like those with high water content (FAST Logistics Group, 2024; Mercier et al., 2017). To prevent foodborne illness and maintain product quality, cold chain logistics must be properly managed, especially in these challenging environments (Mustafa et al., 2024).

The moisture content and water activity levels were key indicators of the safety and storage lifespan of chicken feet luncheon meat. The product's moisture levels and water activity were consistent with those

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of highly perishable processed meats, suggesting a high risk of spoilage. If moisture levels are high and water activity is maximized, microorganisms can multiply quickly unless effective preservation techniques are implemented. The product needed to be refrigerated immediately and had a short shelf life at room temperature. Based on these parameters, chicken feet luncheon meat should be handled with caution, and manufacturers must implement robust food safety protocols across their operations.

In the Philippines, the Food and Drug Administration (FDA) strictly enforces registration requirements for processed meats by warning the public about unregistered luncheon meats and requiring importers to secure both a License to Operate (LTO) and a Certificate of Product Registration (CPR) before bringing products into the country (Food and Drug Administration, 2023). The agency's regulatory framework demonstrates a strong commitment to food safety by making product registration mandatory, aligning with global standards that emphasize the need for HACCP and proper regulatory compliance in meat processing (Leung, 2025; Friesla, 2023).

Consumer Acceptability of Chicken Feet Luncheon Meat

Consumer acceptance of new types of protein, especially those made from underused poultry by-products, is vital for the commercial feasibility and potential of sustainable meat substitutes. The current study examined the acceptability of chicken feet luncheon meat in three trials by evaluating the key sensory traits that influence consumer preference and buying decisions.

The overall scores for the chicken feet luncheon meat were displayed in the consumer acceptability (Table 8), which is divided into four major sensory categories: appearance, aroma, taste, and texture. These factors were assessed by three different consumer groups: (10) Potential customers, TVL track SHS students, and instructors of food-related courses.

Table 8. *Summary of Consumer Acceptability for Chicken Feet Luncheon Meat*

Quality Indicators	Potential Consumers (10)	SHS Students - TVL Track (10)	Teachers who are teaching food-related courses (10)	Weighted Mean	Adjectival Description
Appearance	4.90	4.90	4.70	4.83	Highly Acceptable
Aroma	4.80	5.00	4.90	4.90	Highly Acceptable
Taste	5.00	5.00	5.00	5.00	Highly Acceptable
Texture	4.90	5.00	4.80	4.90	Highly Acceptable
Average Weighted Mean	4.90	4.98	4.85	4.91	Highly Acceptable

Legend: 4.51-5.00 - Highly Acceptable, 3.51-4.50 - Acceptable, 2.51-3.50 - Moderately Acceptable, 1.51-2.50 - Slightly Acceptable, 1.00-1.50 – Undesirable

All ratings fell within the "Highly Acceptable" range (4.70-5.00), indicating strong consumer acceptance across all sensory attributes. With a perfect weighted mean of 5.00, which indicated unanimous approval across all consumer groups, taste received the highest rating. While appearance received a score of 4.83, both texture and aroma received weighted mean of 4.90. The product's high level of consumer acceptability was confirmed by the overall weighted mean of 4.91.

It is noteworthy that the ratingswere consistent across the three consumer groups. Regardless of background or level of expertise, all three groups gave taste a 5-point rating, indicating universal appeal. The sensory experiences were consistently of high quality, with no notable weaknesses found in any

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parameter during the evaluation, as indicated by the small variation in scores across various attributes (ranging from 4.83 to 5.00).

The outstanding acceptability scores indicated that luncheon meat products made from chicken feet have a lot of commercial potential. Given that flavor was found a crucial factor in determining a product's success in the processed meat market, the flawless taste score of 5 points is especially noteworthy. Since texture is usually the most difficult component to create alternative protein products, the high texture rating of (4.90) was found equally noteworthy. This achievement showed that the processing techniques successfully converted the distinctive, collagen-rich structure of chicken feet into a desired texture for meat products.

With appropriate product development and formulation, consumers can easily accept unconventional protein sources, according to the near-perfect scores across all sensory attributes. The adoption of sustainable protein options and circular economy solutions in food production as a whole was greatly impacted by this finding. According to market research, chicken foot luncheon meat may gain widespread consumer acceptance by addressing sustainability issues and offering solutions for protein security.

The high levels of acceptance attained in this study are higher than the usual initial ratings for non-traditional protein sources. Siddiqui and associates. According to (2022), on a 7-point hedonic scale, initial acceptance ratings of unconventional protein sources typically fall between 3.5 and 4.5, indicating ratings from moderately acceptable to acceptable. The current study's outstanding product optimization is demonstrated by ratings above 4.8.

The degree to which consumers accept and prefer processed meat products was largely determined by a variety of product attributes and quality perceptions. Taste and best-before date are the most crucial factors, though it varies by country (Török et al. 2023). The study's taste acceptability score of 5 points emphasizes how important flavor optimization is to consumer acceptance.

Customers have different opinions about processed meat products. They rely on socioeconomic and cultural backgrounds, which means that rather than just familiarity or culinary skill, consumers' knowledge, experience, and demographic characteristics are the primary factors influencing their acceptance (de Araújo et al., 2022; Hong et al., 2023). The product appeared to have successfully overcome potential cultural or experiential barriers, as evidenced by the study's consistent high ratings across a variety of consumer groups.

The high acceptance of appearance (4.83) aligns with the findings of Cardona et al. (2023), who noted that appearance and color are the most important intrinsic features influencing consumer preference and acceptability of meat and processed meat products. This underscores the significance of aesthetics in developing alternative protein products.

The effective use of chicken feet demonstrates that the functional value of processed poultry by-products can be achieved through bioactive protein hydrolysates and improved physicochemical properties (Akramzadeh et al., 2020; Ozturk-Kerimoglu et al., 2023). Poultry by-products offer a resourceful way to process meat, supporting a sustainability strategy that does not compromise product quality, as indicated by current knowledge about poultry nutrition and welfare optimization (Korver, 2023).

Comparison of Chicken Feet Luncheon Meat with the existing Similar Product

There are many Luncheon meat products that are available in the local market that are made of different raw materials and varies in nutritional content and cost. The Chicken Feet Luncheon Meat were economical and contained essential nutrients that are useful and vital for human health. It also has characteristics that made it stand out from other products that it will make it marketable at even practical purchase.

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Table 9. *Comparison of Nutrient Content per 55 grams of Chicken Feet Luncheon Meat to Existing Similar Local Products*

Nutrient Content	Chicken Feet Luncheon Meat	Product B	Product C
Calories (kcal)	89	78	100
Calories from Fat	1	42	60
Total Fat (g)	0	5	7
Total Carbohydrates (g)	16	2	3
Total Protein (g)	6	7	6

In comparison of the Chicken Feet Luncheon Meat to the local products, it is shown that the Chicken Feet Luncheon meat can offer a unique and nutritionally beneficial profile when compared to local products. According to the nutrient comparison, the developed product has 89 kcal per 55 grams, which puts it in the moderate calorie range when compared to Products A (78 kcal) and B (100 kcal). With only 1 kcal from fat and 0 grams of total fat, it also offers a significant reduction in fat content, making it significantly leaner than both Product A and Product B, which have noticeably higher fat levels. The product also has a higher carbohydrate content of 16 grams, which is significantly more than the 2-3 grams seen in other local items. This implies that chicken feet luncheon meat can provide increased energy availability and satisfaction. Although its protein level of 6 grams is significantly lower than Product A's (7 grams), it is equivalent to Product B and is within a healthy range. Overall, the statistics show that chicken feet luncheon meat can be a healthier, lower-fat, and nutritionally balanced alternative to current local luncheon meat products, emphasizing the importance of chicken feet as a potential ingredient in the development of nutritious and novel food items.

Cost

In terms of cost, the price of Chicken Feet Luncheon Meat is ₱137.74 while the cost of the existing product which is product B was ₱195, and product C was ₱166.5. the cost of Chicken Feet Luncheon Meat is almost the same as the existing product in the market which was presented in Table 10.

Table 10. *Comparison of Cost of Chicken Feet Luncheon Meat to Existing Similar Product*

	Chicken Feet Luncheon Meat	Product B	Product C
Net Weight (g)	350	350	397
Price (Php)	137.74	195	166.5
Price per gram (Php)	0.39	0.56	0.42

The results of the comparison expressed that Chicken Feet can compete in terms of marketability since its price is close enough to the existing luncheon meat in the market having the same weight, competitively priced given its added nutritional value, despite being slightly higher per gram than the lowest-cost commercial alternative.

Nutritional Composition of Chicken Feet Luncheon Meat

Nutritional Facts is used to determine the nutritional content of food and food products. Result of the nutritional analysis conducted at the Department of Science and Technology (DOST), Legazpi City. Table 11 presents the Nutritional Facts of Chicken Feet Luncheon Meat.

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Table 11. *Nutritional Composition of Chicken Feet Luncheon Meat per 1/5pc(55g) serving*

Nutrient	Amount per Serving	% RDI/RNI*
Calories (kcal)	89	4
Calories from Fat	1	-
Total Fat (g)	0	-
Total Carbohydrates (g)	16	-
Total Protein (g)	6	9

*Percent RDI/RNI values are based on 2015 PDRI percent RDI/RNI for males 19-29 years old

The nutritional composition of the developed chicken feet luncheon meat was evaluated to determine its caloric content and macronutrient profile per 55-gram serving. Understanding these values is essential in assessing the product's potential as a healthier and sustainable alternative to conventional processed meats, which are often high in fat and sodium (Török et al., 2023). Table 8 shows that a 55 g serving of chicken feet luncheon meat provides 89 kcal (4% RDI), with 1 kcal from fat, 0 g total fat, 16 g total carbohydrates, and 6 g total protein (9% RDI). The percent RDI/RNI values are based on the 2015 PDRI for Filipino males aged 19–29 years old. The nutritional results reveal that the product is low in calories and virtually fat-free, as indicated by the absence of total fat. Its 16 g carbohydrate content serves as the main energy source, while the 6 g of protein contributes meaningfully to daily protein requirements. This macronutrient profile aligns with trends in developing healthier processed meat options that reduce fat while maintaining acceptable protein levels (Siddiqui et al., 2022). The data suggest that the chicken feet luncheon meat is a low-fat, moderate-carbohydrate, and protein-contributing product. Its low caloric and zero-fat composition may appeal to consumers seeking healthier alternatives to traditional luncheon meats, which typically contain higher fat levels. The 9% RDI protein contribution further demonstrates that chicken feet—although an unconventional protein source—can be formulated into a nutritionally functional meat product, supporting ongoing efforts to utilize underused animal by-products for value-added food production (Akramzadeh et al., 2020). This nutritional profile strengthens the product's potential for commercialization as a health-oriented and sustainable luncheon meat alternative. The results also align with current research promoting the utilization of poultry by-products to support circular food systems and reduce waste while still meeting consumer nutritional needs (Ozturk-Kerimoglu et al., 2023). These findings complement the sensory evaluation results presented in the succeeding sections.

DISCUSSION

Implications

The study has considerable significance for global initiatives related to food security, sustainability, and public health. It supports the circular economy model by effectively transforming poultry processing waste into a nutritious food product and addressing the challenge of limited protein sources in developing nations. The research methodology and outcomes are both reproducible and adaptable to other regions, particularly where poultry farming is prevalent and chicken feet are underutilized.

The study is also significant in relation to the United Nations Sustainable Development Goals, particularly SDG 2 (Zero Hunger), SDG 3 (Good Health and Well-being), and SDG 12 (Responsible Consumption and Production). The growing prevalence of obesity and the elevated healthcare costs associated with diet-related illnesses may be addressed through the development of low-fat and collagen-enriched processed meat products. Furthermore, the study proposes an adaptable strategy for small and medium-sized enterprises within developing nations to convert agricultural waste into value-added products, thereby potentially fostering employment and economic growth in rural regions.

The broader scope also relates to the field of food policy and regulation, as research highlights the necessity for new standards and frameworks. These initiatives are designed to foster innovation in sustainable protein development while safeguarding food safety. This endeavor contributes to the existing

body of knowledge aimed at transforming food systems into more sustainable, healthier, and economically viable entities. Such modifications aim to address the complex challenges of feeding the expanding global population while conserving limited environmental resources.

Limitations

The study involved 30 evaluators in a localized setting. Yeast and mold testing alone does not establish pathogen absence or commercial sterility. The source reports differing ingredient quantities across the recipe, trials, and costing records; the reported values are retained and require reconciliation. The source does not provide sufficient validated shelf-life or thermal-process evidence to establish ambient storage safety. Collagen content and clinical health benefits were not directly established by the reported laboratory results.

CONCLUSION

This paper demonstrated that the concept of a nutritionally viable luncheon meat product made from chicken feet could be realized in the Philippines in response to the increasing demand for sustainable protein sources and the value-added use of poultry by-products. The study successfully achieved its primary objective of developing a luncheon meat made from chicken feet that met established food safety standards and contained notable nutritional value. The product produced had unique features that distinguished it from traditional luncheon meats, such as a very low fat content, a moderate protein level, and a high collagen content (accounting for about 70% of all proteins).

The quality analysis of the chicken feet luncheon meat revealed that it possessed acceptable physicochemical characteristics, with a moisture content of 58.93%, which contributed to its pleasing texture and palatability. The water activity level of 0.98, however, indicated the product's sensitivity to microbial growth, making it necessary to maintain strict cold chain control and implement effective preservation measures during storage and distribution. The microbiological analysis revealed that product safety was satisfactory, with 100 CFU/g of yeast and mold, which fell within the acceptable limits for processed meat products as stipulated in the Philippine National Standards. This suggested that the manufacturing processes were efficient and that food safety protocols were followed.

The chicken feet luncheon meat also provided several nutritional benefits compared to conventional luncheon meat products, as it was significantly lower in fat and calories (89 kcal/55 g), making it suitable for health-conscious consumers and those on weight-control diets. The moderate amount of protein, at 6 g per 55 g serving, provided 9% of the recommended daily value of protein for males aged 19–29 years. The high amount of collagen offered potential health benefits for joints and skin, which are not commonly found in conventional processed meat products. The low carbohydrate composition reflected the use of functional ingredients, such as binding agents and texture-enhancing agents, which helped stabilize the product and improve consumer acceptability.

A relative comparison with other products available on the market indicated that chicken feet luncheon meat could occupy a unique niche in the processed meat market, as it offered healthier and distinctive nutritional benefits. The low-fat content, moderate calorie density, and collagen-rich protein composition of the product positioned it favorably against conventional luncheon meat, which is typically rich in fat (ranging from 10–20% of total content) and contains higher caloric values. This positioning aligns with the trend toward healthier processed meat alternatives and the increasing market demand for such products in the Philippines, where chicken consumption reached 1,995 thousand metric tons in 2023.

The successful development of chicken feet luncheon meat contributed to the valorization of poultry by-products, supporting sustainable food production practices and addressing food security concerns through innovative protein utilization. The research demonstrated that with proper processing techniques, chicken feet could be transformed into a commercially viable product that meets regulatory

standards while providing nutritional benefits. However, the high water activity and moisture content require careful consideration of packaging, storage, and distribution strategies to ensure product safety and shelf stability.

Recommendations

Future researchers are encouraged to focus on optimizing preservation methods, conducting comprehensive sensory evaluation studies, and performing cost–benefit analyses to determine commercial viability and market positioning strategies. The findings of this study provide a foundation for the development of sustainable, nutritious, and economically viable alternatives to conventional luncheon meat products, contributing to the advancement of food technology and sustainable protein production in the Philippines.

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